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PATENT

APPENDIX

(clean copy of the pending independent claims)

1 5. A method for writing data to a cache memory wherein a data write-in
2 request is issued from an information processor to a storage control apparatus, the storage control
3 apparatus including a plurality of channel control units each having an interface with the
4 information processor; a disk control unit having an interface with a storage device for storing
5 data; a cache memory disposed in each channel control unit for temporarily storing data to be
6 interchanged between the information processor and the storage device; a dedicated data transfer
7 path between at least two cache memories; and a connector unit to provide data paths among the
8 plurality of channel control units and the disk control unit separate from the dedicated data
9 transfer path, comprising:

10 receiving data to be written from the information processor;
11 writing the data to be written to the cache memory of a first channel control unit;
12 transmitting the data to be written through the dedicated data transfer path to a
13 second channel control unit connected to the first channel control unit;
14 receiving through the dedicated data transfer path an acknowledgement indicating
15 that writing of the transmitted data to the cache memory disposed in the second channel control
16 unit has completed; and
17 transmitting the acknowledgement to the information processor to notify the
18 information processor that data written to the cache memory of the second channel control unit
19 has completed.

1 6. A method in a storage control apparatus for reading in data stored in a
2 second cache memory to a first cache memory, the storage control apparatus including a plurality
3 of channel control units each having an interface with an information processor; a disk control
4 unit having an interface with a storage device for storing data; a plurality of first cache memories
5 each disposed in one of the channel control units for temporarily storing data to be interchanged
6 between the information processor and the storage device, the first cache memory of at least two
7 of the channel control units being connected to one another through a dedicated data transfer
8 path; ; and a connector unit to provide data paths among the plurality of channel control units
9 and the disk control unit separate from the dedicated data transfer path, comprising:

transmitting a read-out command of the data to the second cache memory;
acquiring the data from the second cache memory;
writing the acquired data to the first cache memory of a first channel control unit;
transmitting the acquired data through the dedicated data transfer path to a second
channel control unit connected to the first channel control unit; and
receiving an acknowledgement from the second channel control unit indicating
that the acquired data has been written to the first cache memory of the second channel control
unit .

7. A method performed by a channel control unit for reading out data
wherein a data read-out request is issued from an information processor to a storage control
apparatus, the storage control apparatus including a plurality of channel control units each having
an interface with the information processor; a disk control unit having an interface with a storage
device for storing data; a first cache memory in each of the channel control units for temporarily
storing data, to be interchanged between the information processor and the storage device, the
first cache memory of at least two of the channel control units being connected to one another
through a dedicated data transfer path; a plurality of second cache memories; and a connector
unit to provide data paths among the plurality of channel control units and the disk control unit
separate from the dedicated data transfer path, comprising:

receiving from the information processor a read-out command for data for which
an address is specified;

determining whether the data at the specified address is stored in the first cache
memory of a first channel control unit;

transmitting a read-out command of the data to one of the second cache
memories if the data at the specified address is not stored in the first cache memory of the first
channel control unit;

acquiring the data from the second cache memory;

writing the acquired data to the first cache memory of the first channel control
unit;

21 transmitting the acquired data through the dedicated data transfer path to a second
22 channel control unit connected to the first channel control unit;
23 receiving from the second channel control unit an acknowledgement indicating
24 that writing of the acquired data to the first cache memory disposed in the other second control
25 unit has completed; and
26 transmitting the acquired data to the information processor.

1 12. A channel control unit in a storage control apparatus including a plurality
2 of channel control units each having an interface with an information processor; a disk control
3 unit having an interface with a storage device for storing data; a first cache memory in each
4 channel control unit for temporarily storing data to be interchanged between the information
5 processor and the storage device, the first cache memory of at least two of the channel control
6 units being connected to one another by a dedicated data transfer path used for storing mutually
7 the temporarily stored data; a second cache memory; and a connector unit to provide data paths
8 among the plurality of channel control units, the disk control unit and the second cache memories
9 separate from the dedicated data transfer path, the channel control unit comprising:

10 a transmitter for transmitting to the second cache memory a read-out command
11 for data stored in the second cache memory;

12 an acquiring portion for acquiring the data from the second cache memory;
13 a writing portion for writing the acquired data to the first cache memory of the
14 channel control unit;

15 a transmitter for transmitting the acquired data through the dedicated data transfer
16 path to another channel control unit connected to the channel control unit; and

17 a receiver for receiving from the other channel control unit an acknowledgement
18 notifying that the writing of the transmitted data to the first cache memory disposed in the other
19 channel control unit has completed.

1 13. (A channel control unit in a storage control apparatus including a plurality
2 of channel control units each having an interface with an information processor; a disk control
3 unit having an interface with a storage device for storing data; a first cache memory in each
4 channel control unit for temporarily storing data to be interchanged between the information
5 processor and the storage device, the first cache memory of at least two of the channel control
6 units being connected to one another through a dedicated data transfer path; at least one second
7 cache memory; and a connector unit to provide data paths among the plurality of channel control
8 units, the disk control unit and the at least one second cache memory separate from the dedicated
9 data transfer path , the channel control unit comprising:

10 a receiver for receiving from the information processor a read-out command for
11 data for which the address is specified;

12 a determining portion for determining whether the data at the specified address is
13 stored in the first cache memory of the channel control unit;

14 a transmitter for transmitting the read-out command for the data to the at least one
15 second cache memory if the data at the specified address is not stored in the first cache memory;

16 an acquiring portion for acquiring the data from the at least one second cache
17 memory;

18 a writing portion for writing the acquired data to the first cache memory of the
19 channel control unit;

20 a transmitter for transmitting the acquired data through the dedicated data transfer
21 path to another channel control unit connected to the channel control unit;

22 a receiver for receiving from the other channel control unit an acknowledgement
23 indicating that the writing of the acquired data to the first cache memory disposed in the other
24 channel control unit has completed; and

25 a transmitter for transmitting the acquired data to the information processor.

1 17. A computer-readable medium containing a computer program executed on
2 a first channel control unit in a storage control apparatus including a plurality of channel control
3 units each having an interface with the information processor; a disk control unit having an
4 interface with a storage device for storing data; a cache memory in each channel unit for
5 temporarily storing data to be interchanged between the information processor and the storage
6 device, the cache memory of at least two of the plurality of channel control units being
7 connected to one another through a dedicated data transfer path used for storing mutually the
8 temporarily stored data; and a connector unit to provide data paths among the plurality of
9 channel control units and the disk control unit separate from the dedicated data transfer path, the
10 computer program configured to cause the first channel control unit to perform steps comprising:
11 receiving data to be written from the information processor;
12 writing the data to be written to the cache memory of the first channel control
13 unit;
14 transmitting the data to be written through the dedicated data transfer path to a
15 second channel control unit connected to the first channel control unit;
16 receiving from the second channel control unit through the dedicated data transfer
17 path an acknowledgement indicating that the writing of the data to the cache memory disposed in
18 the second channel control unit has completed; and
19 transmitting the acknowledgement to the information processor.

1 18. A computer-readable medium containing a computer program executed on
2 a first channel control unit in a storage control apparatus including a plurality of channel control
3 units each having an interface with an information processor; a disk control unit having an
4 interface with a storage device for storing data; a first cache memory in each channel unit for
5 temporarily storing data to be interchanged between the information processor and the storage
6 device, the first cache memory of at least two of the plurality of channel control units being
7 connected to one another through a dedicated data transfer path used; at least two second cache
8 memories; and a connector unit to provide data paths among the plurality of channel control
9 units, the disk control unit and the at least two second cache memories separate from the

dedicated data transfer path, the computer program configured to cause the first channel control unit to perform steps comprising:

- transmitting to one of the second cache memories a read-out command for data stored therein;
- acquiring the data from the one of the second cache memories;
- writing the acquired data to the first cache memory of the first channel control unit;
- transmitting the acquired data through the dedicated data transfer path to a second channel control unit connected to the first channel control unit; and
- receiving from the second channel control unit an acknowledgement indicating that the writing of the acquired data to the first cache memory disposed in the second channel control unit has completed.

19. A computer-readable medium containing a computer program executed on a first channel control unit in a storage control apparatus including a plurality of channel control units each having an interface with an information processor; a disk control unit having an interface with a storage device for storing data; a first cache memory in each channel unit for temporarily storing data to be interchanged between the information processor and the storage device, the first cache memory of at least two of the plurality of channel control units being connected to one another through a dedicated data transfer path used for storing mutually the temporarily stored data; at least two second cache memories; and a connector unit to provide data paths among the plurality of channel control units, the disk control unit and the second cache memories separate from the dedicated data transfer path, the computer program configured to cause the first channel control unit to perform steps comprising:

- receiving from the information processor a read-out command for data for which the address is specified;
- determining whether the data at the specified address is stored in the first cache memory of the first channel control unit;

16 transmitting a read-out command for the data at the specified address to one of the
17 second cache memories if the data is not stored in the first cache memory;
18 acquiring the data from the one of the second cache memories;
19 writing the acquired data to the first cache memory;
20 transmitting the acquired data through the dedicated data transfer path to a second
21 channel control unit connected to the first channel control unit;
22 receiving from the second channel control unit an acknowledgement indicating
23 that the writing of the acquired data to the first cache memory disposed in the second channel
24 control unit has completed; and
25 transmitting the acquired data to the information processor.